

# Superconductivity of Magnesium Diboride MgB<sub>2</sub>

Tuesday 17 April 2001

- [A Brief History](#)
- [Latest News](#) [total (15), new (0)]
- [Publications/Communications](#) [total (126), new (1)]
- [Links](#) [total (4), new (0)]
- [Contact Us](#)

- [A Brief History](#)

In January 2001, J. Akimitsu [1], [30] announced superconductivity in magnesium diboride (MgB<sub>2</sub>) with a critical temperature of 39K. This caused an excitement in the superconductivity community. At the time of writing these lines, several research groups in the world are investigating the properties of this material.

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- [New metallic superconductor makes an immediate impact](#), Physics Web, 2 April 2001.
- [UK physicists defy the weakest link](#), Physics Web, 6 March 2001.

- Off the shelf superconductors, Nature, 26 Feb 2001.
- Genie in a bottle, Nature 410, 23-24, 26 Feb 2001.
- Exciting times for superconductors, Physics Web, 26 Feb 2001.
- Superconductivity finding could aid in building high-speed computers, Nando Times, 25 Feb 2001.
- New Superconductor Charges Up Physicists, Chicago Tribune, 25 Feb 2001.
- 'Superconductor' Gain Holds Promise of Energy Efficiency, The Washington Post, 24 Feb 2001.
- Physicists Thrill to Finding of Superconductor, New York Times, 24 Feb 2001.
- Surprising 'superconducting' discovery, CNN, 23 Feb 2001.
- All-metal Superconductivity at 40K, Physics News Update, 13 Feb 2001.
- 39 K Superconductivity in MgB<sub>2</sub>, High T<sub>c</sub> Update, 6 Feb 2001.
- Metal superconductors reach new high, PhysicsWeb, 2 Feb 2001.

## ● Publications/Communications

[1] J. Akimitsu, Symposium on Transition Metal Oxides. Sendai, 10 Jan 2001.

[2] J. Kortus et al., Superconductivity of metallic boron in MgB<sub>2</sub>, cond-mat/0101446, 31 Jan 2001.

- [3] S. L. Bud'ko et al., Boron Isotope Effect in Superconducting  $\text{MgB}_2$ , cond-mat/0101463, 1 Feb 2001. Physical Review Letters, Volume 86, pages 1877-1880 (2001).
- [4] D. K. Finnemore et al., Thermodynamic and Transport Properties of Superconducting  $\text{Mg}^{10}\text{B}_2$ , cond-mat/0102114, 7 Feb 2001. Physical Review Letters, Volume 86, pages 2420-2422 (2001).
- [5] V. Sampathkumaran et al., Observation of superconductivity in  $\text{Y}_2\text{PdGe}_3$ , structurally the same as  $\text{MgB}_2$ , cond-mat/0102110, 7 Feb 2001.
- [6] J. E. Hirsch, Hole Superconductivity in  $\text{MgB}_2$ : a high  $T_c$  cuprate without Cu, cond-mat/0102110, 8 Feb 2001.
- [7] Y. Takano et al., Superconducting Properties of  $\text{MgB}_2$  Bulk Materials Prepared by High Pressure Sintering, cond-mat/0102167, 12 Feb 2001.
- [8] D. C. Larbalestier et al., Strongly linked current flow in polycrystalline forms of the new superconductor  $\text{MgB}_2$ , cond-mat/0102216, 13 Feb 2001. Nature, volume 410, pages 186-189 (2001).
- [9] C. U. Jung et al., Temperature- and magnetic-field-dependences of normal state resistivity of  $\text{MgB}_2$  prepared at high temperature and high pressure condition, cond-mat/0102215, 13 Feb 2001.
- [10] G. Rubio-Bollinger et al., Tunnelling spectroscopy in small grains of superconducting  $\text{MgB}_2$ , cond-mat/0102242, 14 Feb 2001.
- [11] P. C. Canfield et al., Superconductivity in Dense  $\text{MgB}_2$  Wires, cond-mat/0102289, 16 Feb 2001. Physical Review Letters, Volume

86, pages 2423-2426 (2001).

[12] B. Lorenz et al., High Pressure Study on MgB<sub>2</sub>, cond-mat/0102264, 16 Feb 2001.

[13] J. S. Slusky et al., Loss of superconductivity and structural transition in Mg<sub>1-x</sub>Al<sub>x</sub>B<sub>2</sub>, cond-mat/0102262, 16 Feb 2001.

[14] Mung-Seog Kim et al., Prominent bulk pinning effect in newly discovered MgB<sub>2</sub> superconductor, cond-mat/0102338, 20 Feb 2001.

[15] H. Kotegawa et al., Evidence for Strong-coupling S-wave Superconductivity in MgB<sub>2</sub>: <sup>11</sup>B NMR Study, cond-mat/0102334, 20 Feb 2001.

[16] Amos Sharoni et al., Tunnelling spectroscopy measurement of the superconductor gap parameter of MgB<sub>2</sub>, cond-mat/0102325, 20 Feb 2001.

[17] S. X. Dou et al., Flux Jumping and Bulk-to-Granular Transition in the Magnetization of a Compacted and Sintered MgB<sub>2</sub> Superconductor, cond-mat/0102320, 20 Feb 2001.

[18] W. N. Kang et al., Hole carrier of MgB<sub>2</sub> determined by the Hall Measurement, cond-mat/0102313, 20 Feb 2001.

[19] G. Karapetrov et al., Scanning Tunnelling Spectroscopy in MgB<sub>2</sub>, cond-mat/0102312, 20 Feb 2001.

[20] G. Satta et al., Electronic and structural properties of superconducting diborides and calcium disilicide in the AlB<sub>2</sub> structure, cond-mat/0102358, 21 Feb 2001.

[21] Y. Bugoslavsky et al., Critical currents and vortex dynamics in

superconducting MgB<sub>2</sub>, cond-mat/0102353, 21 Feb 2001. Nature, volume 410, pages 563-565 (2001).

[22] Herbert Schmidt et al., Energy Gap form Tunnelling and Metallic Sharvin Contacts onto MgB<sub>2</sub>: Evidence for a Weakened Surface Layer, cond-mat/0102389, 22 Feb 2001.

[23] C. U. Jung et al., Effect of sintering temperature under high pressure in the superconductivity for MgB<sub>2</sub>, cond-mat/0102383, 22 Feb 2001.

[24] S. L. Bud'ko et al., Magnetoresistivity and Complete  $H_{c2}(T)$  in MgB<sub>2</sub>, cond-mat/0102413, 23 Feb 2001.

[25] A. Bianconi et al., High  $T_c$  superconductivity at a critical strain and charge density in diborides, cond-mat/0102410, 23 Feb 2001.

[26] J. M. An et al., Superconductivity of MgB<sub>2</sub> from Hole-Doped Covalent Bonds, cond-mat/0102391, 23 Feb 2001.

[27] M. D. Sumption et al., Transport Current in MgB<sub>2</sub> based Superconducting Strand at 4.2 K and Self-Field, cond-mat/0102441, 26 Feb 2001.

[28] H. H. Wen et al., Giant quantum fluctuation in the new superconductor MgB<sub>2</sub>, cond-mat/0102436, 26 Feb 2001.

[29] R. K. Kremer et al., Heat Capacity of MgB<sub>2</sub>: Evidence of Moderately Strong Coupling Behavior, cond-mat/0102432, 26 Feb 2001.

[30] A. Gerashenko et al., Electronic States of Boron in Superconducting MgB<sub>2</sub> Studied by <sup>11</sup>B NMR, cond-mat/0102421, 26

Feb 2001.

[31] J. Nagamatsu et al., Superconductivity at 39 K in magnesium diboride, Nature, volume 410, pages 63-64 (2001), 26 Feb 2001.

[32] Taku J Sato et al., Vibrational Density of States in Superconducting MgB<sub>2</sub>, cond-mat/0102468, 27 Feb 2001.

[33] I. Loa et al., Calculated elastic and electronic properties of MgB<sub>2</sub> at high pressures, cond-mat/0102462, 27 Feb 2001.

[34] Y. Kong et al., Electron-phonon interaction in the normal and superconducting states of MgB<sub>2</sub>, cond-mat/0102499, 28 Feb 2001.

[35] Gun Yong Sung et al., Microstructure of the highly dense MgB<sub>2</sub> superconductor by TEM, cond-mat/0102498, 28 Feb 2001.

[36] S. Suzuki et al., Two-Dimensional Sigma-Hole Systems in Boron Layers: A First-Principles Study Mg<sub>1-x</sub>Na<sub>x</sub>B<sub>2</sub> and Mg<sub>1-x</sub>Al<sub>x</sub>B<sub>2</sub>, cond-mat/0102484, 28 Feb 2001.

[37] J. E. Hirsch et al., Electron-Phonon or Hole Superconductivity in MgB<sub>2</sub>?, cond-mat/0102479, 28 Feb 2001.

[38] Ch. Walti et al., Medium Strength Electron-Phonon Coupling in Superconducting MgB<sub>2</sub>: A Specific Heat Study, cond-mat/0102522, 1 Mar 2001.

[39] K. -H. Müller et al., The upper critical field in superconducting MgB<sub>2</sub>, cond-mat/0102517, 1 Mar 2001.

[40] E. Saito et al., Pressure dependence of T<sub>c</sub> in the MgB<sub>2</sub> superconductor as probed by resistivity measurements, cond-mat/0102511, 1 Mar 2001. Journal of Physics: Condensed Matter,

volume 13, L 267-L270 (2001)

[41] I. Felner, Absence of Superconductivity in  $\text{BeB}_2$ , cond-mat/0102508, 1 Mar 2001.

[42] K. Prassides et al., Compressibility of the  $\text{MgB}_2$  Superconductor, cond-mat/0102507, 1 Mar 2001.

[43] T. Vogt et al., Compressibility and Electronic Structure of  $\text{MgB}_2$  up to 8 Gpa, cond-mat/0102480, 1 Mar 2001.

[44] J. K. Jung et al.,  $^{11}\text{B}$  NMR and Relaxation in  $\text{MgB}_2$  Superconductor, cond-mat/0103040, 2 Mar 2001.

[45] S. L. Li et al., Lower Critical Field at Odds with A S-Wave Superconductivity in The New Superconductor  $\text{MgB}_2$ , cond-mat/0103032, 2 Mar 2001.

[46] X. H. Chen et al., Penetration Depth and Anisotropy in  $\text{MgB}_2$ , cond-mat/0103029, 2 Mar 2001.

[47] M. Imada, Superconductivity Driven by the Interband Coulomb Interaction and Implications for the Superconducting Mechanism of  $\text{MgB}_2$ , cond-mat/0103006, 2 Mar 2001.

[48] J. D. Jorgensen et al., Lattice Properties of  $\text{MgB}_2$  versus Temperature and Pressure, cond-mat/0103067, 5 Mar 2001.

[49] R. Osborn et al., Phonon Density-of-States in  $\text{MgB}_2$ , cond-mat/0103064, 5 Mar 2001.

[50] C. Panagopoulos et al., Penetration Depth Measurements in  $\text{MgB}_2$ : Evidence for Unconventional Superconductivity, cond-mat/0103060, 5 Mar 2001.

- [51] Y. P. Sun et al., Superconductivity at 49 K in copper doping magnesium diboride, cond-mat/0103101, 6 Mar 2001.
- [52] K. Voelker et al., Acoustic Plasmons in MgB<sub>2</sub>, cond-mat/0103082, 6 Mar 2001.
- [53] Y. G. Zhao et al., Effect of Li doping on structure and superconducting transition temperature of Mg<sub>1-x</sub>Li<sub>x</sub>B<sub>2</sub>, cond-mat/0103077, 6 Mar 2001.
- [54] T. Takahashi et al., High-Resolution Photoemission Study of MgB<sub>2</sub>, cond-mat/0103079, 7 Mar 2001.
- [55] M. Kambara et al., High intergranular critical currents in metallic MgB<sub>2</sub> superconductor, Superconductor Science and Technology, volume 14, L5-L7 (2001). 7 Mar 2001.
- [56] J. S. Ahn et al., Carbon substitution effect in MgB<sub>2</sub>, cond-mat/0103169, 8 Mar 2001.
- [57] B. Gorshunov et al., Optical measurements of the superconducting gap in MgB<sub>2</sub>, cond-mat/0103164, 8 Mar 2001.
- [58] W. N. Kang et al., Fluctuation Magnetoconductance in MgB<sub>2</sub>, cond-mat/0103161, 8 Mar 2001.
- [59] N. I. Medvedeva et al., Electronic structure of superconducting MgB<sub>2</sub> and related binary and ternary borides, cond-mat/0103157, 8 Mar 2001.
- [60] S. V. Shulga et al., The upper critical field problem in MgB<sub>2</sub>, cond-mat/0103154, 8 Mar 2001.
- [61] A. Brinkman et al., Superconducting thin films of MgB<sub>2</sub> on



(001)-Si by pulsed laser deposition, cond-mat/0103198, 9 Mar 2001.

[62] Y. Wang et al., Specific heat in the superconducting and normal state (2-300 K, 0-16 Teslas), and magnetic susceptibility of the 38-K superconductor MgB<sub>2</sub>: evidence for a multicomponent gap, cond-mat/0103181, 9 Mar 2001.

[63] W. N. Kang et al., Epitaxial MgB<sub>2</sub> superconducting thin films with a transition temperature of 39 Kelvin, cond-mat/0103179, 9 Mar 2001.

[64] Kijoon H. P. Kim et al., Origin of the high DC transport critical current density for the MgB<sub>2</sub> superconductor, cond-mat/0103176, 9 Mar 2001.

[65] R. P. Vasquez et al., X-ray Photoemission Study of MgB<sub>2</sub>, cond-mat/0103215, 12 Mar 2001.

[66] A. Bianconi et al., A Superconductor Made by a Metal Heterostructure at the Atomic Limit Tuned at the "Shape Resonance": MgB<sub>2</sub>, cond-mat/0103211, 12 Mar 2001.

[67] T. Takenobu et al., Intralayer Carbon Substitution in the MgB<sub>2</sub> Superconductor, cond-mat/0103241, 13 Mar 2001.

[68] O. F. de Lima et al., Anisotropic superconducting properties of aligned MgB<sub>2</sub> crystallites, cond-mat/0103287, 14 Mar 2001.

[69] G. Baskaran, RVB Contribution to Superconductivity in MgB<sub>2</sub>, cond-mat/0103308, 15 Mar 2001.

[70] Amish G. Joshi et al., Magnetization studies on superconducting MgB<sub>2</sub>- lower and upper critical fields and critical current density, cond-mat/0103302, 15 Mar 2001.

[71] T. He et al., Superconductivity in the non-oxide Perovskite MgCNi<sub>2</sub>, cond-mat/0103296, 15 Mar 2001.

[72] K. -P. Bohnen et al., Phonon dispersion and electron-phonon coupling in MgB<sub>2</sub> and AlB<sub>2</sub>, cond-mat/0103319, 16 Mar 2001.

[73] Zi-Kui Liu et al., Thermodynamics of the Mg-B system: Implications for the deposition of MgB<sub>2</sub> thin films, cond-mat/0103335, 19 Mar 2001.

[74] A. E. Karkin et al., Superconducting properties of MgB<sub>2</sub> probed by radiation-induced disordering, cond-mat/0103344, 19 Mar 2001.

[75] S. M. Kazakov et al., Substitution effect of Zn and Cu in MgB<sub>2</sub> on T<sub>c</sub> and structure, cond-mat/0103350, 19 Mar 2001.

[76] Mahito Kohmoto et al., Enhancement of superconductive critical temperatures in almost empty or full bands in two dimensions: possible relevance to  $\beta$ -HfNCl, C<sub>60</sub> and MgB<sub>2</sub>, cond-mat/0103352, 19 Mar 2001.

[77] Janhavi P. Joshi et al., Non-resonant microwave absorption studies of superconducting MgB<sub>2</sub>, cond-mat/0103369, 19 Mar 2001.

[78] C. E. Cunningham et al., Synthesis and Processing of MgB<sub>2</sub> powders and wires, cond-mat/0103390, 20 Mar 2001.

[79] A. Sharoni et al., Spatial variations of the superconducting gap structure in MgB<sub>2</sub>/Al composite, cond-mat/0103407, 21 Mar 2001.

[80] A. Handstein et al., Fully dense MgB<sub>2</sub> superconductor textured by hot deformation, cond-mat/0103408, 21 Mar 2001.

[81] N. Hakim et al., Microwave properties of superconducting

MgB<sub>2</sub>, cond-mat/0103422, 21 Mar 2001.

[82] Kunihiro Yamaji, Two-Band-Type Superconducting Instability in MgB<sub>2</sub>, cond-mat/0103431, 22 Mar 2001.

[83] Z. Y. Fan et al., Experimental study of MgB<sub>2</sub> decomposition, cond-mat/0103435, 23 Mar 2001.

[84] T. Yildirim et al., Giant anharmonicity and non-linear electron-phonon coupling in MgB<sub>2</sub>; A combined first-principles calculations and neutron scattering study, cond-mat/0103469, 23 Mar 2001.

[85] Armando Reyes-Serrato et al, Ab initio Hartree-Fock with electronic correlation study of the electronic properties of MgB<sub>2</sub>, cond-mat/0103477, 24 Mar 2001.

[86] H. Tou et al., Evidence for Spin-Singlet Superconductivity in Layered MgB<sub>2</sub>, cond-mat/0103484, 24 Mar 2001.

[87] E. Z. Kurmaev et al., Electronic structure of MgB<sub>2</sub>: X-ray emission and absorption spectra, cond-mat/0103487, 24 Mar 2001.

[88] A. Kohen et al., Symmetry and Temperature dependence of the Order parameter in MgB<sub>2</sub> from point contact measurements, cond-mat/0103512, 27 Mar 2001.

[89] J. R. Thompson et al., High temporal stability of supercurrents in MgB<sub>2</sub> materials, cond-mat/0103514, 27 Mar 2001.

[90] H. H. Wen et al., Flux dynamics and vortex phase diagram of the new superconductor MgB<sub>2</sub>, cond-mat/0103521, 27 Mar 2001.

[91] N. Kristoffel et al., Two-band model and MgB<sub>2</sub> superconductivity, cond-mat/0103536, 27 Mar 2001.

- [92] T. Tomita et al., The dependence of  $T_c$  on Hydrostatic Pressure in Superconducting MgB<sub>2</sub>, cond-mat/0103538, 27 Mar 2001.
- [93] S. R. Shinde et al., Superconducting MgB<sub>2</sub> thin films by pulsed laser deposition, cond-mat/0103542, 27 Mar 2001.
- [94] D. H. A. Blank et al., Superconducting Mg-B films by pulsed laser deposition in an in-situ two-step process using multi-component targets, cond-mat/0103543, 27 Mar 2001.
- [95] G. Grasso et al., Large transport critical currents in unsintered MgB<sub>2</sub> superconducting tapes, cond-mat/0103563, 28 Mar 2001.
- [96] M. Paranthaman et al., Superconducting MgB<sub>2</sub> films via precursor post-processing approach, cond-mat/0103569, 28 Mar 2001.
- [97] Amy Y. Liu et al., Beyond Eliashberg superconductivity in MgB<sub>2</sub>: anharmonicity, two-photon scattering, and multiple gaps, cond-mat/0103570, 28 Mar 2001.
- [98] D. Kaczorowski et al., Incipient superconductivity in TaB<sub>2</sub>, cond-mat/0103571, 28 Mar 2001.
- [99] G. Grassano et al., In-situ Magnesium Diboride Superconducting Thin Films grown by Pulsed Laser Deposition, cond-mat/0103572, 28 Mar 2001.
- [100] A. A. Zhukov et al., Microwave Surface Resistance in MgB<sub>2</sub>, cond-mat/0103587, 29 Mar 2001.
- [101] H. Y. Zhai et al., Superconducting Magnesium diboride films on Silicon with  $T_{c0} \sim 24K$  grown via vacuum annealing from stoichiometric precursors, cond-mat/0103588, 29 Mar 2001.

- [102] T. A. Callcott et al., Soft x-ray spectroscopy measurements of the p-like density of states of B in MgB<sub>2</sub> and evidence for surface boron oxides on exposed surfaces, cond-mat/0103593, 29 Mar 2001.
- [103] H. Y. Zhai et al., Growth mechanisms of superconducting MgB<sub>2</sub> films prepared by various methods, cond-mat/0103618, 2 Apr 2001.
- [104] B. Lorenz et al., Thermoelectric power and transport properties of pure and Al-doped MgB<sub>2</sub>, cond-mat/0104041, 3 Apr 2001.
- [105] A. Plecenik et al., Superconducting parameters of MgB<sub>2</sub> obtained on MgB<sub>2</sub>/Ag and MgB<sub>2</sub>/In junction, cond-mat/0104038, 3 Apr 2001.
- [106] X. K. Chen et al., Investigation of the Superconducting Gap in MgB<sub>2</sub> by Raman Spectroscopy, cond-mat/0104005, 3 Apr 2001.
- [107] D. P. Young et al., Structure and Superconducting Properties of "BeB<sub>2</sub>", cond-mat/0104063, 4 Apr 2001.
- [108] Alexander F. Goncharov et al., Raman spectrum and lattice parameters of MgB<sub>2</sub> as a function pressure, cond-mat/0104042, 4 Apr 2001.
- [109] L. Gozzelino et al., Critical state analysis in MgB<sub>2</sub> bulk by means of quantitative MO technique, cond-mat/0104069, 5 Apr 2001.
- [110] J. B. Neaton et al., On the possibility of superconductivity at higher temperatures in sp-valent diborides, cond-mat/0104098, 6 Apr 2001.
- [111] G. Fuchs et al., Upper critical field and irreversibility line in superconducting MgB<sub>2</sub>, cond-mat/0104088, 6 Apr 2001.

[112] M. Paranthaman et al., Effect of Carbon-Doping in Bulk Superconducting MgB<sub>2</sub> Samples, cond-mat/0104086, 6 Apr 2001.

[113] K. Kawano et al., Evidence for high inter-granular current flow in single-phase polycrystalline MgB<sub>2</sub> superconductor, cond-mat/0104114, 9 Apr 2001.

[114] T. H. Johansen et al., Complex flux dynamics in MgB<sub>2</sub> films, cond-mat/0104113, 9 Apr 2001.

[115] M. J. Qin et al., Dependence of the flux creep activation energy on current density and magnetic field for MgB<sub>2</sub> superconductor, cond-mat/0104112, 9 Apr 2001.

[116] Y. Bugoslavsky et al., Enhancement of the high field critical current density of superconducting MgB<sub>2</sub> by proton irradiation, cond-mat/0104156, 10 Apr 2001.

[117] Stephen Haas et al., Anisotropic s-wave superconductivity in MgB<sub>2</sub>, cond-mat/0104207, 12 Apr 2001.

[118] F. Bouquet et al., Specific Heat of Mg<sup>11</sup>B<sub>2</sub>, cond-mat/0104206, 12 Apr 2001.

[119] E. Bauer et al., Thermal conductivity of superconducting MgB<sub>2</sub>, cond-mat/0104203, 12 Apr 2001.

[120] Xiangang et al., The bond structure of MgB<sub>2</sub> with different lattice constants, cond-mat/0104216, 13 Apr 2001.

[121] D. G. Hinks et al., The reduced total isotope effect and its implications on the nature of superconductivity in MgB<sub>2</sub>, cond-mat/0104242, 13 Apr 2001.

[122] S. Jin et al., High transport critical currents in dense, metal-clad superconductor wires of  $\text{MgB}_2$ , cond-mat/0104236, 13 Apr 2001.

[123] S. H. Moon et al., High critical current densities in superconducting  $\text{MgB}_2$  thin films, cond-mat/0104230, 13 Apr 2001.

[124] P. Ravindran et al., Detailed electronic structure studies on superconducting  $\text{MgB}_2$  and related compounds, cond-mat/0104253, 16 Apr 2001.

[125] Z. W. Zhao et al., Smearing of Superconducting Critical Current Density by Dense and Small Flux Jumps in  $\text{MgB}_2$  Thin Films, cond-mat/0104249, 16 Apr 2001.

[126] W. N. Kang et al.,  $\text{MgB}_2$  superconducting thin films with a transition temperature of 39 Kelvin, cond-mat/0104266, 17 Apr 2001.

- Links

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Last updated 17 April 2001